BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Subsidiary Diploma in Applied Science Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Environmental Science Pearson BTEC International Level 3 Extended Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Environmental Science
Unit number and title	**Unit 17: Electrical Circuits and their Applications**
Learning aim	**C:** Examine AC and DC production and health and safety aspects in domestic and industrial applications
Assignment title	**AC/DC**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a trainee laboratory technician working for a local aluminium smelting works. Like many large industries, the smelting works is a huge consumer of electricity and has its own electrical generating plant in the form of a hydroelectric plant. This sends excess electricity to the National Grid which, in turn, distributes it to local homes. The plant also has an induction furnace to produce aluminium ingots after the aluminium has been smelted. As part of your training you have been asked by the Health and Safety committee of the company to develop an electrical safety awareness booklet for their employees.

Task	Prepare a booklet titled 'Electrical Safety Awareness' that has the following sections: <u>Section 1 – AC and DC current</u> **Explain** the differences and similarities of the properties of AC and DC current in simple circuits • Use diagrams based on simple laboratory experiments to illustrate how both AC and DC electricity are produced • Carry out simple practical activities to produce both DC and AC electricity and record your findings. • **Explain,** using diagrams, how Fleming's Left Hand Rule (FLH) applies to electric motors and how Fleming's Right Hand Rule (FRH) applies to AC generators. • **Discuss** the need for a split ring commutator in a DC motor. • Describe how DC electricity can be stored and why AC electricity cannot be stored in batteries. • Illustrate, with a fully labelled graph, the difference between AC and DC electricity as seen using an oscilloscope. • Using your AC graph, add an appropriate scale on the vertical axis and label the 'peak voltage value' and 'RMS

	voltage value'. Explain why RMS voltage value is more useful than the peak value. Show, by calculation, the peak voltage value if the effective voltage value in the UK is 230V. Section 2 - Effects of AC and DC electricity on the human physiology In the context of the dangers of working with electricity, use a diagram of the body to illustrate specific points and supplementary notes to **explain**: • The typical resistance values or current pathways in the body. What are the implications of this and is it different for AC compared to DC electricity? • The consequence of skin resistance in different conditions e.g. in contact with the ground, when moist • The effect of the length of current exposure time and the amount of electrical current. How is this different for AC compared to DC electricity? • The safe levels of DC voltage • How the heart responds to electric shock and how is this applied to the principles of a defibrillator Section 3 - The National Grid **Explain**, with the aid of diagrams, how AC electricity is produced in an electrical generator facility for use in homes and industry. Apply the fundamental aspects of Fleming's right hand rule for the generator in the power station. You should include: • a reasoned argument as to why a high voltage AC generator should be used rather than a low voltage turbine driven dynamo **Describe** how AC electricity is transferred from the hydroelectric plant to homes and industry. Mathematically account for the need of transformers and high voltages. You should include: • the required voltage for applications of AC electricity around the home and at the smelting plant. • the mathematical comparisons of energy/power loss of transmitting electricity at different voltages Produce a qualitative, reasoned argument which identifies why: • the voltages used to transmit electricity through the national grid for a variety of uses, have been selected and why they may be different at different points in the transfer system • components such as transformers are required in specific parts of the national grid and connections between the hydroelectric plant and the National Grid. Section 4 - Using AC and DC electricity around the home **Discuss, using clearly labelled diagrams and explanatory notes** the principles of the ring main circuit found in houses. You should include: • what is the purpose of the residual current and earth leakage circuit breakers (RCCB and ELCB), and how do they operate? • kettles and hairdryers are often 'double insulated", what is the significance of this? • how do fuses and miniature circuit breakers (MCB's) work in

	domestic appliances and why are they necessary? • how do equipotential earthing systems operate • when using DC equipment such as tablets, games consoles and mobile phones, **discuss** the principles behind 'charging them up' from the AC mains supply. • what are the dangers and inbuilt safety? *(NB whilst these questions give guidance to the range of considerations you should discuss, you must present this in a coherent way.)* <u>Section 5 - Using AC and DC electricity in industry</u> It is essential that the smelting works protects its workers by applying the Electricity at Work Regulations 1989. **Discuss** the specific actions that should be taken and the safety devices that should be used to protect workers when operating and repairing the AC and DC equipment in the plant.
Checklist of evidence required	An electrical safety awareness booklet that has the following content: • An explanation of the differences and similarities of the properties of AC and DC current in simple circuits; • A comparison of the route mean square (RMS) and peak voltage for AC electricity in a simple circuit; • An explanation of the effects and dangers of AC and DC electricity on human physiology; • An evaluation of the principles of AC production and transmission for safe use in the context of providing AC electricity for suitable uses in the home and aluminium processing plant via the National Grid and its connection to the hydroelectric facility; • A discussion of procedures and practices used to minimise risk when working with electricity in the home and industry.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria, you must show that you are able to:
C.D2	Evaluate the principles of AC production and transmission for safe use in suitable applications
C.M3	Compare RMS and peak values of AC electricity
C.M4	Discuss procedures and practices used to minimise risk when working with electricity
C.P3	Explain the similarities and differences of AC and DC electrical circuits
C.P4	Explain the dangers of working with electricity and its effects on human physiology

Sources of information to support you with this Assignment	http://www.hse.gov.uk/pUbns/priced/hsr25.pdf http://www.inbrief.co.uk/employees/electricity-at-work/ https://van.physics.illinois.edu/qa/listing.php?id=6793 http://physicsnet.co.uk/a-level-physics-as-a2/current-electricity/alternating-current-ac/

	http://www.electricaleasy.com/2012/12/basic-construction-and-working-of-dc.html http://www.riotinto.com/aluminium-83.aspx#united%20kingdom http://www.practicalphysics.org/explaining-rms-voltage-and-current.html http://www.homepower.com/articles/microhydro-power/design-installation/electric-side-hydro-power Centres are encouraged to include local employers in delivery by asking them to give guest lectures and provide opportunities for industrial visits and work experience.